Office of the Chief Information Officer

• The GRC OCIO enables and supports an efficient High Technology, High-Performing work environment for NASA GRC and Agency partners •

GVIS – Gee Whiz – WOW: Human Computer Interfaces

Creating New Opportunities

NASA Glenn Graphics and Visualization (GVIS) Team

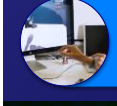
What if you could…

Explore your results more easily and fully?

Detect patterns including potential errors in data ?

Analyze and collaborate on larger data sets ?

Explain your results to others in a more engaging, exciting way ?



Create models in a more natural way?

Convergence of new technologies


Stereo displays


Natural user interfaces


Powerful GPUs


Augmented Reality


Tiled displays


Mobile devices


Immersive Environments


3D printing


Multi-touch surfaces


3D capture devices

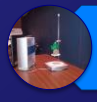
Agenda


Benefits of visualization

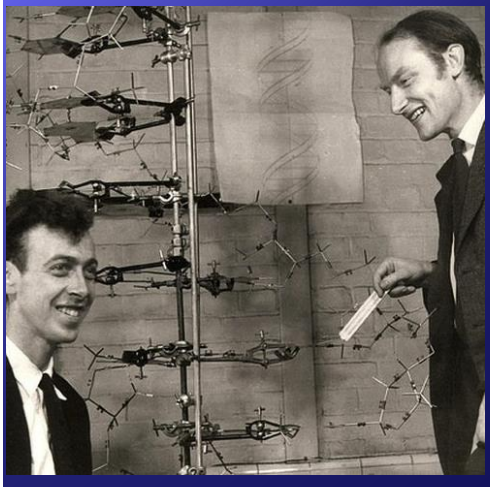

Current visualization and natural user interface technologies

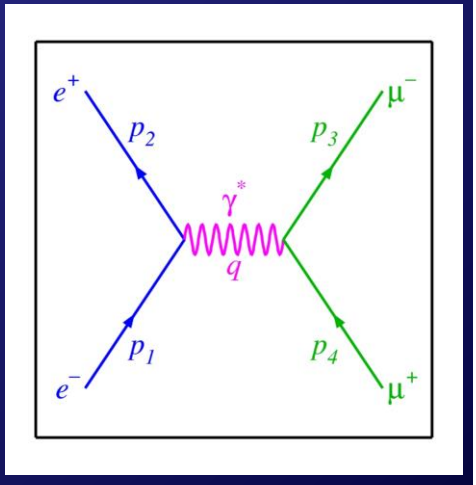

Visualization and natural user interfaces at GRC


Next steps

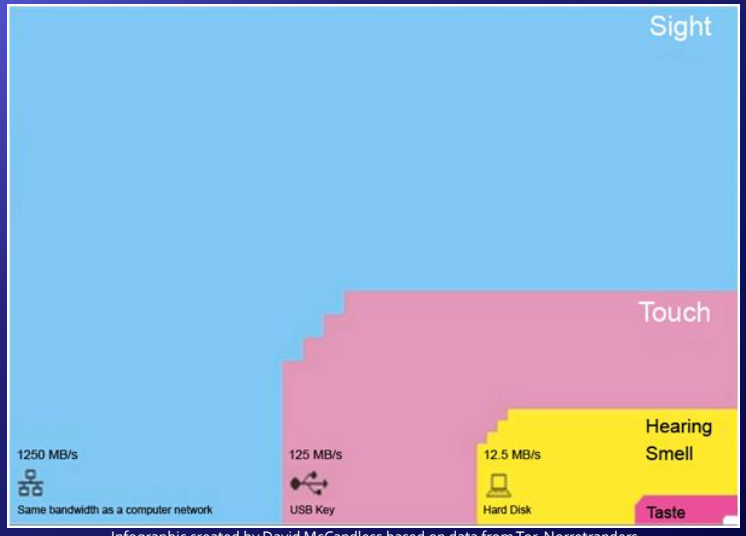

Try out the demos

Visualization: key to discovery & understanding





Bandwidths of human senses



Infographic created by David McCandless based on data from Tor Norretranders

Why visualization matters

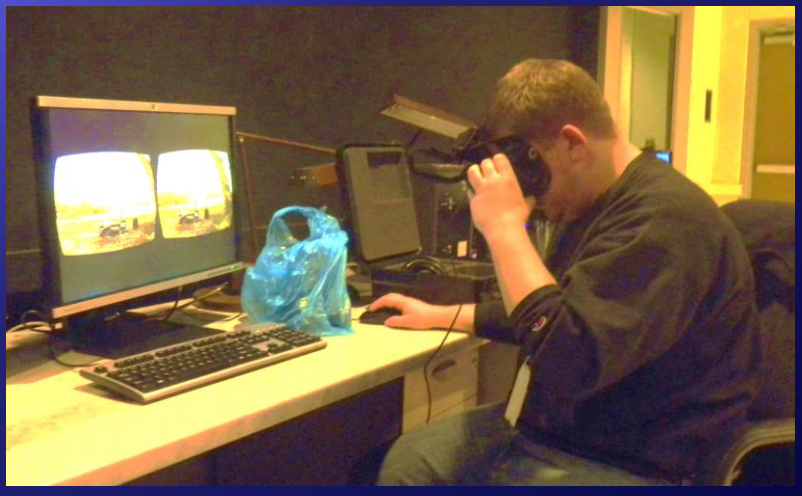
- Enhance working memory
- Detect patterns
- Abstract problems
- Build things we can't build
- See things we can't see
- Go to places we can't go

Stereoscopic Displays

Use BOTH your eyes

Stereoscopic Displays

Oculus Rift at GRC



Visualization and Interactive Displays at GRC

GVIS Portable 3D Displays for Interactive Simulations

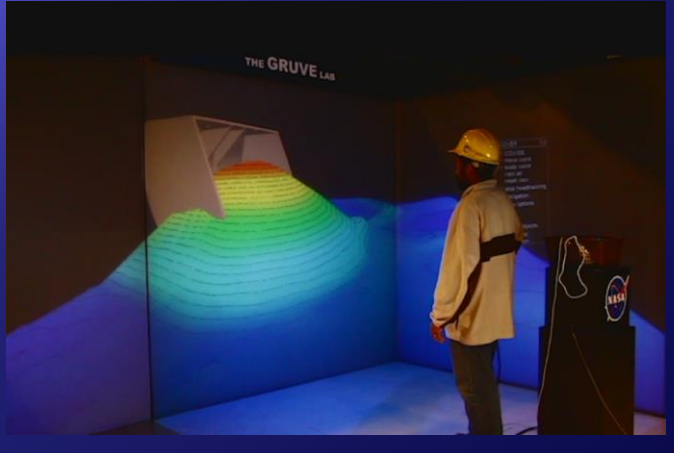
CAVEs

Become immersed in your data

http://www.evl.uic.edu/core.php?mod=4&type=1&indi=424

Visualization and Interactive Displays at GRC

GRUVE Lab - 3D Immersive visualization environment (CAVE)



http://www.youtube.com/watch?v=G5YBR7Kmg8c&

Tiled Displays

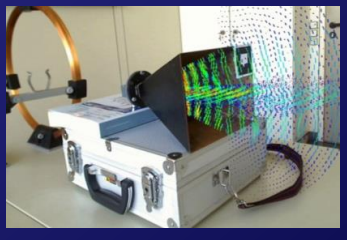
The big picture and the details

Projection Augmented Reality Displays

Put imagery and information where you need it

http://www.youtube.com/watch?v=C1gV928YPTQ#t=10s

Augmented Reality
Real world – only better

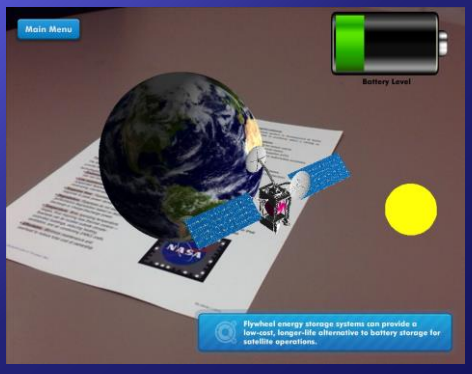


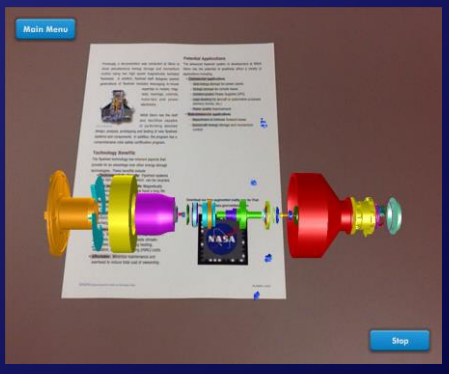
Augmented Reality

https://www.youtube.com/watch?v=gZxK6j4JTHQ#t=26

Visualization and Natural User Interfaces at GRC

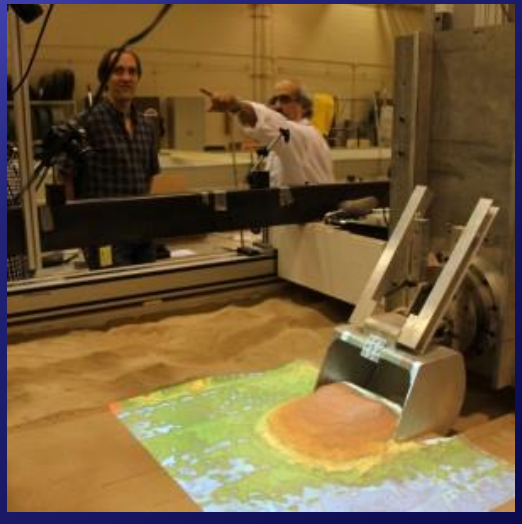
Educational Augmented Reality – Imaging Technology Center





Visualization and Natural User Interfaces at GRC

SLOPE's Augmented Reality Sandbox



Natural user interfaces (NUI)

http://www.youtube.com/watch?v=xNqs_S-zEBY

Evolution of user interfaces

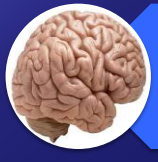
Command Line Interface (CLI)		
Text	Precise	Large cognitive load

Graphical User Interface (GUI)		
Graphics	Metaphor	Exploratory

Natural User Interface (NUI)		
Objects	Direct	Intuitive

Natural User Interfaces (NUI)

Similar to how we interact with real world



Frees brain for cognition, creativity and exploration

Over time becomes invisible to the user

Multi touch displays

Provides a fast and intuitive interface

http://sciencenordic.com/gigantic-multitouch-displays-become-microscopes

Multi touch displays

Provides a fast and intuitive interface

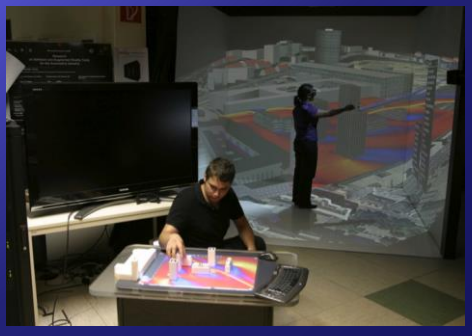
http://vimeo.com/33046498

Visualization and Natural User Interfaces at GRC

55" PixelSense Display

Multi-surface, natural user interface displays

Seamless sharing of data across devices



Multi-surface, natural user interface displays

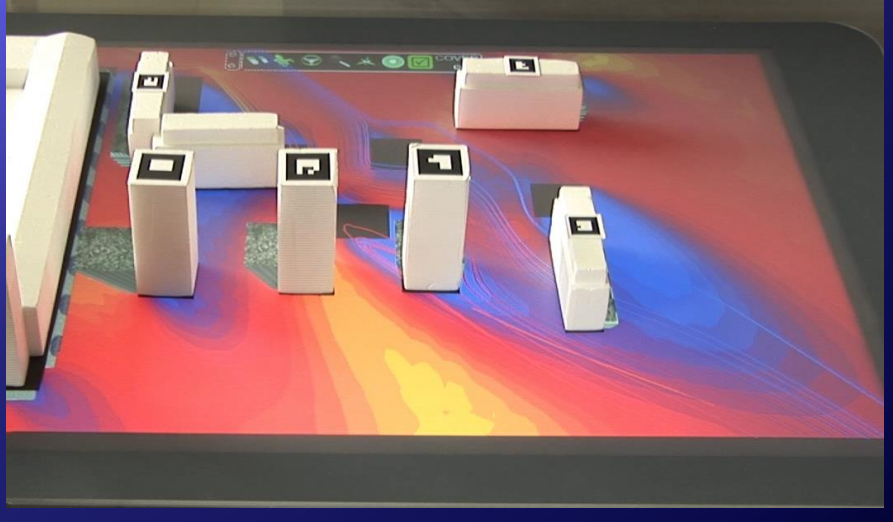
http://www.youtube.com/watch?v=fcMhZ9J0qN8#t=34m

Natural user interface input devices at GRC

Leap Motion and Kinect

Tangible interfaces

Manipulatable digital information with your hands



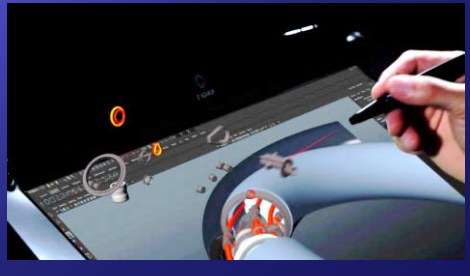
Latest 3D and NUI devices

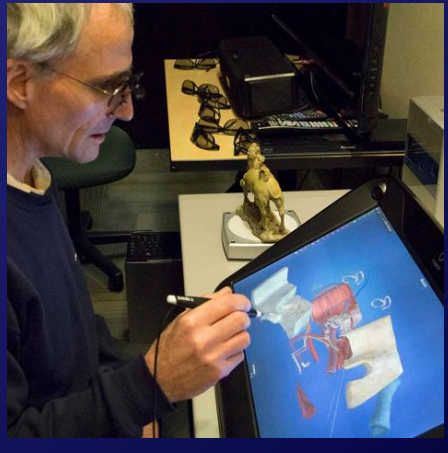
CastAR

http://technicalillusions.com/

Latest 3D and NUI devices

zSpace





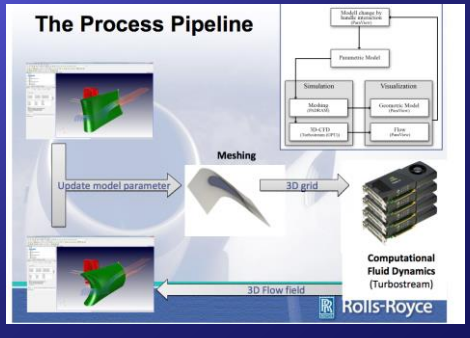
Latest 3D and NUI devices

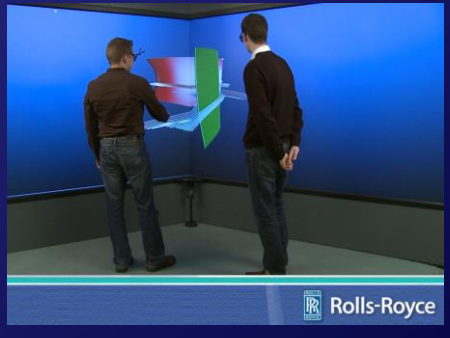
SpaceGlasses

https://www.youtube.com/watch?v=b7I7JuQXttw#t=12s

Interactive, immersive design environments

Virtual Interactive Aerodynamic Design Environment
Rolls Royce





http://www.t-systems-sfr.com/e/downloads/2012/vortraege/7rolls.pdf

3D Scanners

Industrial and for your iPad

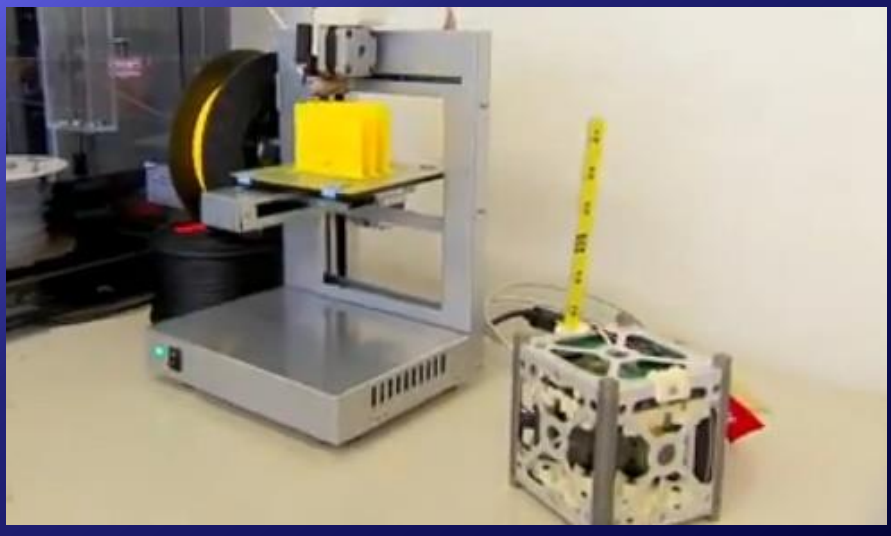
http://www.creaform3d.com/en/applications/oil-and-gas/pipeline-external-corrosion-assessment

http://www.kickstarter.com/projects/occipital/structure-sensor-capture-the-world-in-3d

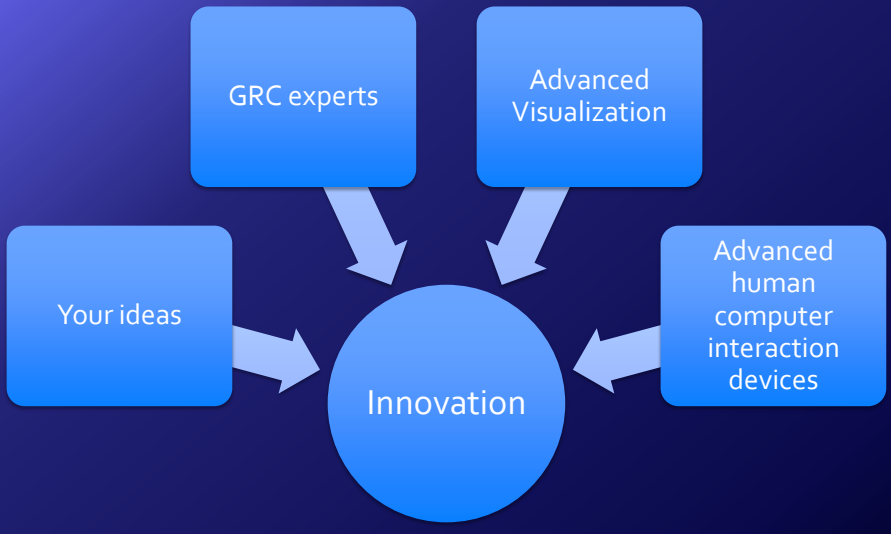
NextEngine 3D scanner

- Applications:
  - Scan biological/abstract forms for simulation
  - Create models of old hardware
  - Reverse engineering
  - Scan and 3D print expensive parts

3D printers



Next steps



NASA Glenn
Graphics & Visualization Lab

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- Brandon Meyer
- Raju Shah, Division Chief, Information and Applications Division
- OCIO Management
- Tristan Hearn
- Gary Nolan
- Eric Mindek
- Vikram Shyam

Backup Slides

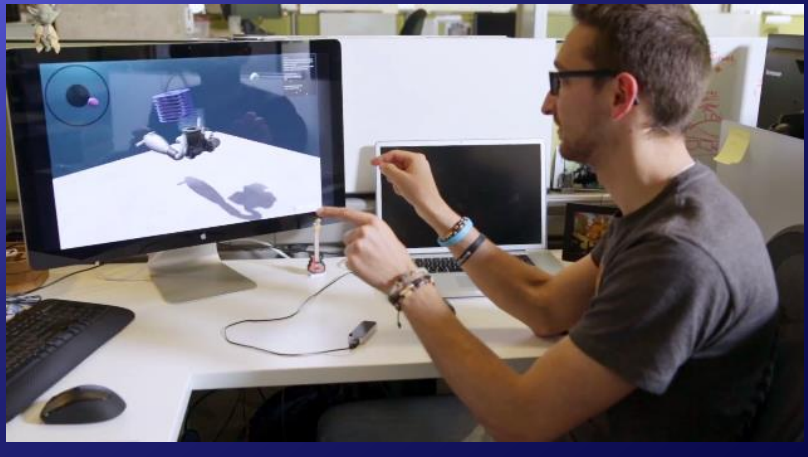
NextEngine 3D scanner

- Takes multiple laser scans of object while object is rotated through 360 degrees.
- Multiple orientations are used.
- Scanning software stitches together images based on common reference markers.
- Depends on lighting, proximity, object emissivity etc.
- Can save to CAD files for manipulation.

Applications:
- Scan biological/abstract forms for simulation.
- Create models of old hardware.
- Reverse engineering.
- Scan and 3D print expensive parts.

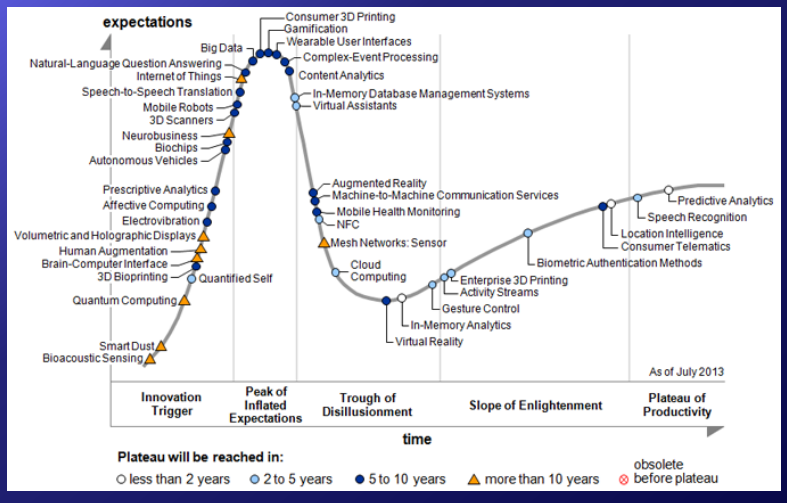
Natural user interface input devices

Leap Motion with CAD

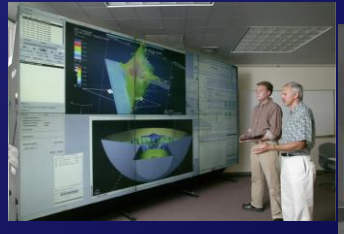


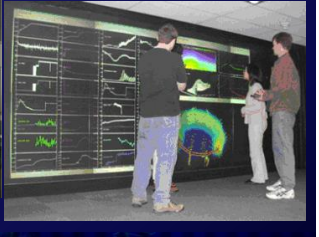
http://www.youtube.com/watch?v=qjSWTpVlvLI#T=105s

2013 Gartner Hype Cycle for Emerging Technologies



http://www.gartner.com/newsroom/id/2575515





AlloSphere

Visualization for Engineers and Scientists

- Confirmation
  - when you have a known hypothesis to test, and you want to produce a picture to test whether it is correct…
- Exploration
  - interactivity is important when you have a new, perhaps complex, dataset that can be viewed in many different ways - especially if you're not even sure yet what questions you need to ask of the data..

Importance of Visualization

- Hal Varian, Google, "The ability to take data—to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it—that's going to be a hugely important skill in the next decades"
- "Some scientists still think that good data visualization is only necessary when presenting work to "the public". In truth, thinking hard about how to learn the most from any data set should always involve some form of graph, map, chart, or other visual statistical display"

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